

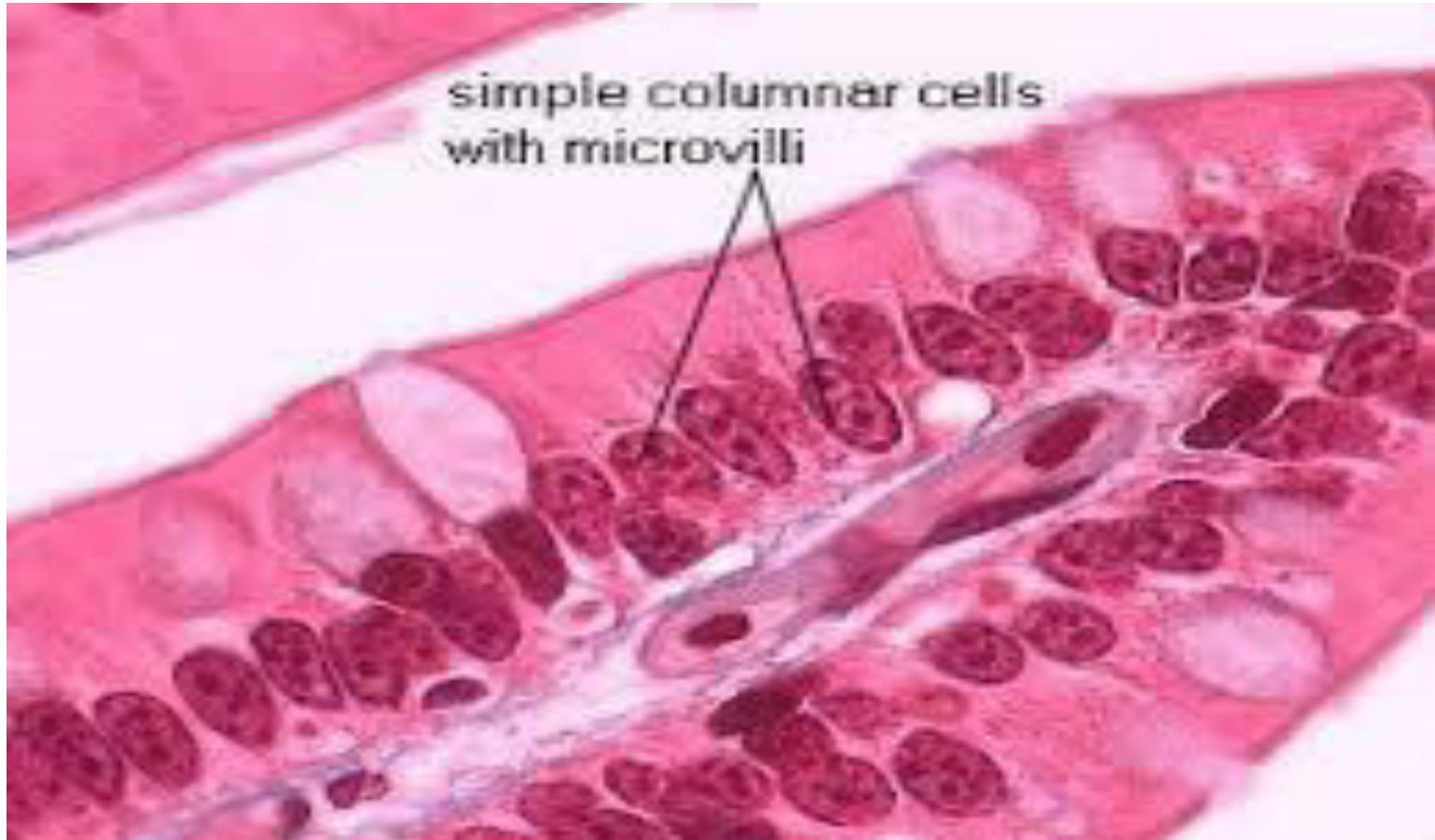
رَبِّ زِدْنِي عِلْمًا ❁

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اے میرے رب! میرے علم میں اضافہ فرما۔

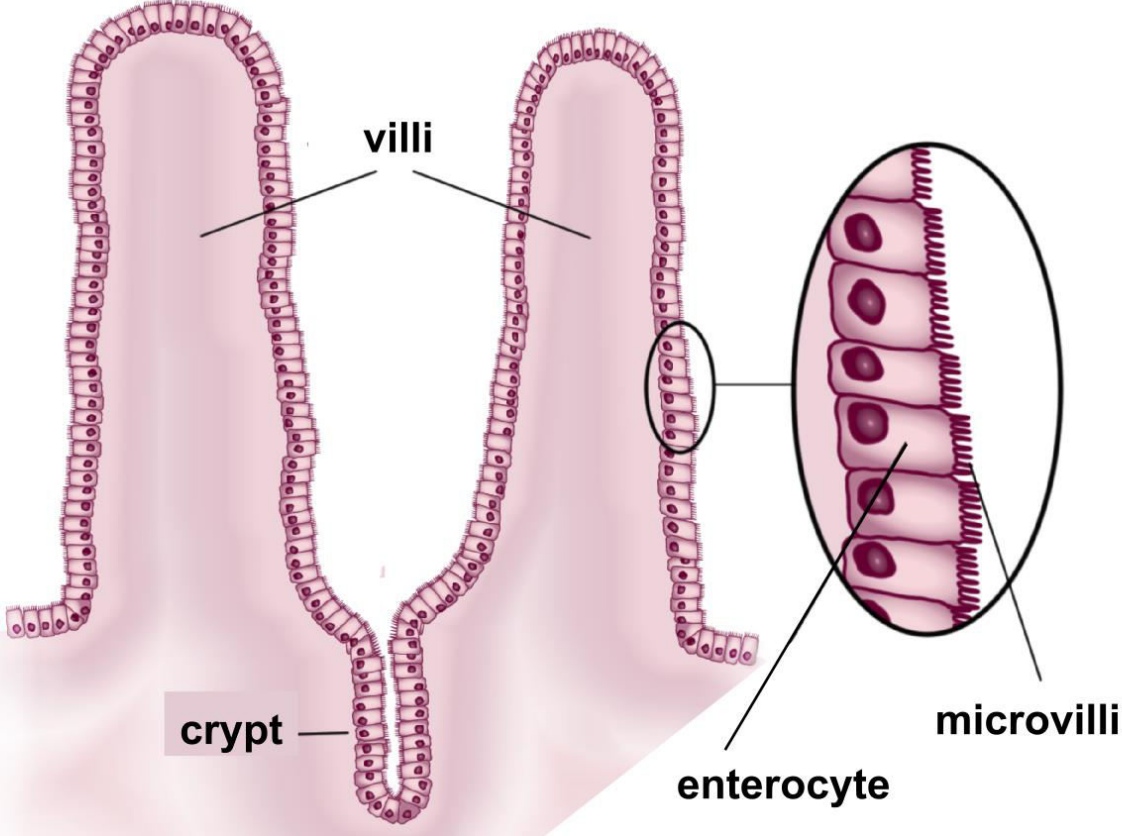
# **Stratified Epithelium**

# Simple columnar with Microvilli



Small intestine  
Gall bladder

**lumen of small intestine**



# Stratified Epithelium

- Contain two or more layers of cells
- Regenerate from below
- Major role is protection
- Are named according to the shape of cells at apical layer

# Classification

The stratified epithelium is classified into subtypes according to the shape of the cells in the superficial layer:

- 1) Stratified squamous epithelium
- 2) Stratified cuboidal epithelium
- 3) Stratified columnar epithelium
- 4) Transitional epithelium

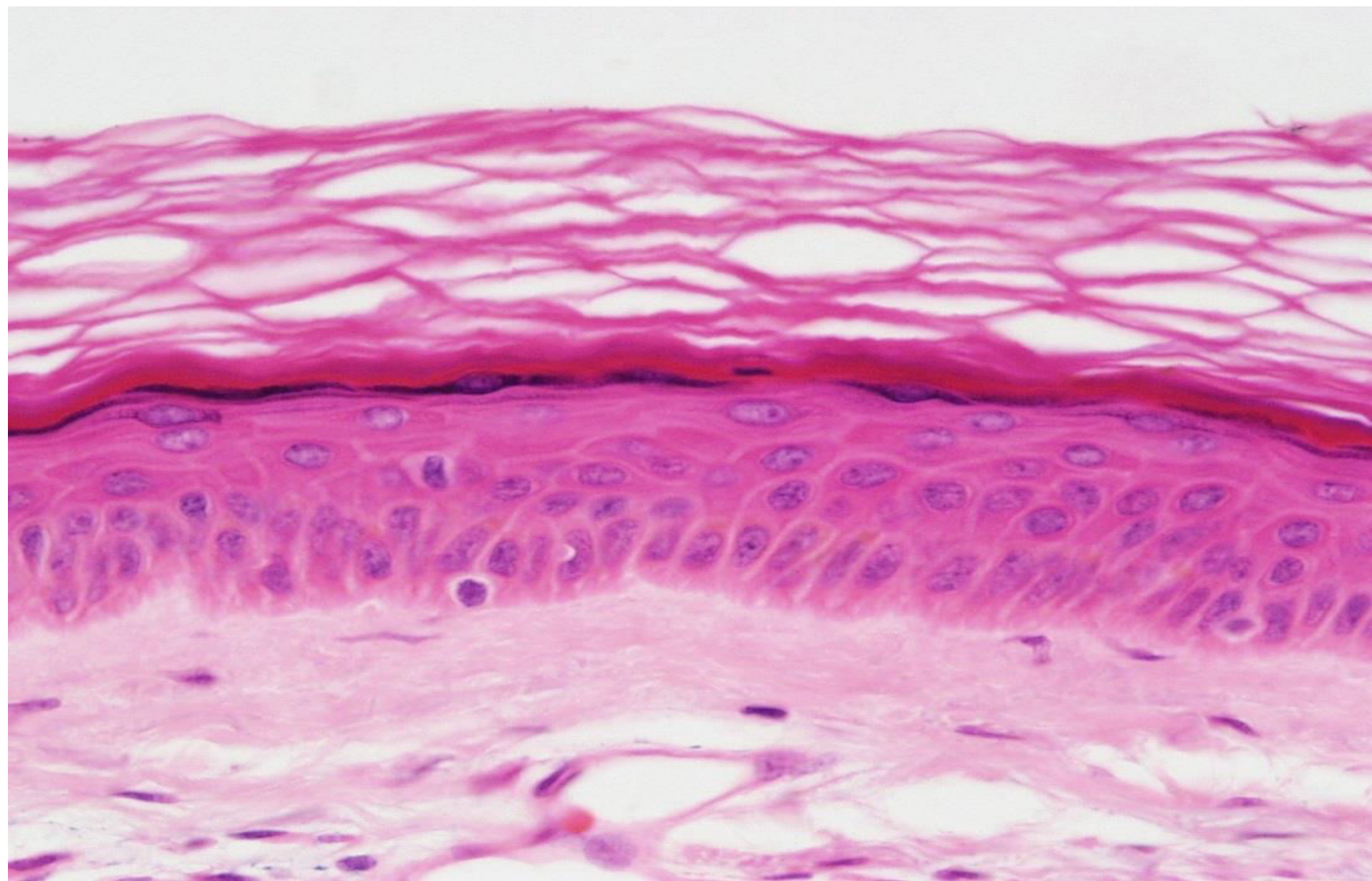
# Stratified squamous epithelium

- Many layers of cells but squamous in shape as the free surface is approached
- Deeper layers of cells appear cuboidal or low columnar than a few layers of larger polygonal cells.
- Thickest epithelial tissue – adapted for protection
- Depending upon superficial cells stratified squamous epithelium are recognized:
  - Keratinized
  - Non keratinized

# Stratified squamous keratinized epithelium

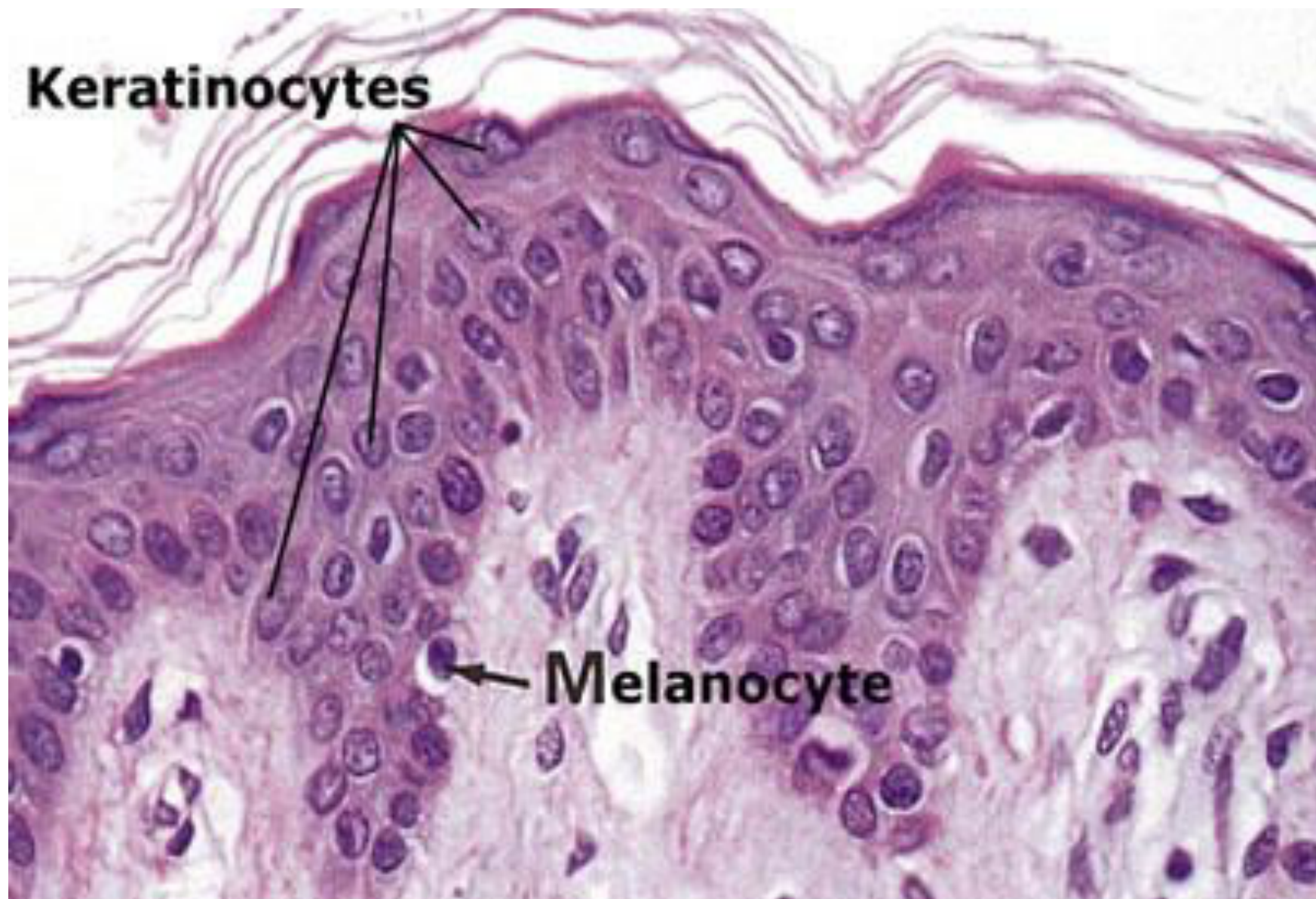
- The cell lose their nuclei and organelles and become dead.
- The cytoplasm of the superficial cells accumulates keratin filaments.
- Example: Epidermis





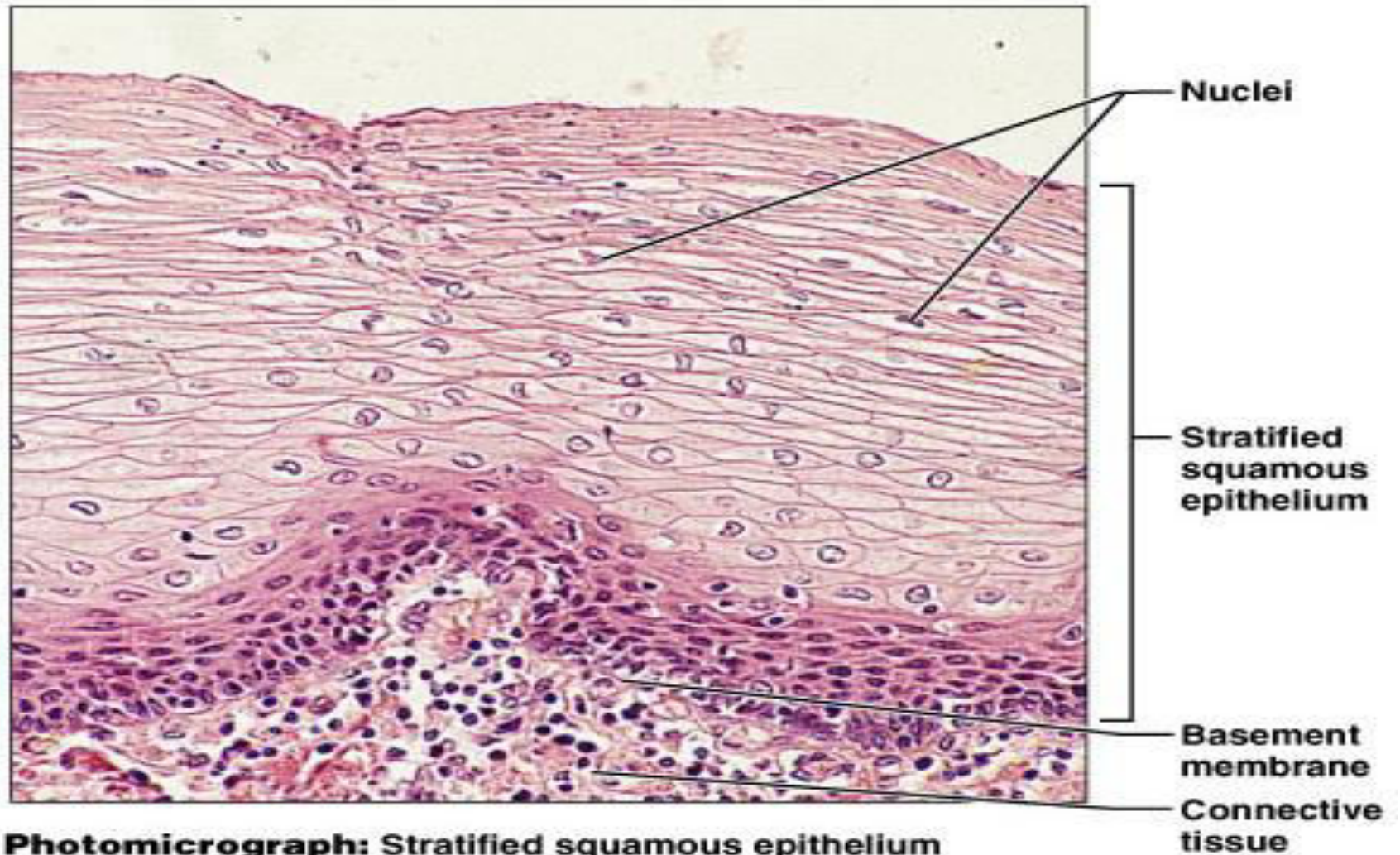
**Keratinocytes**

**Melanocyte**

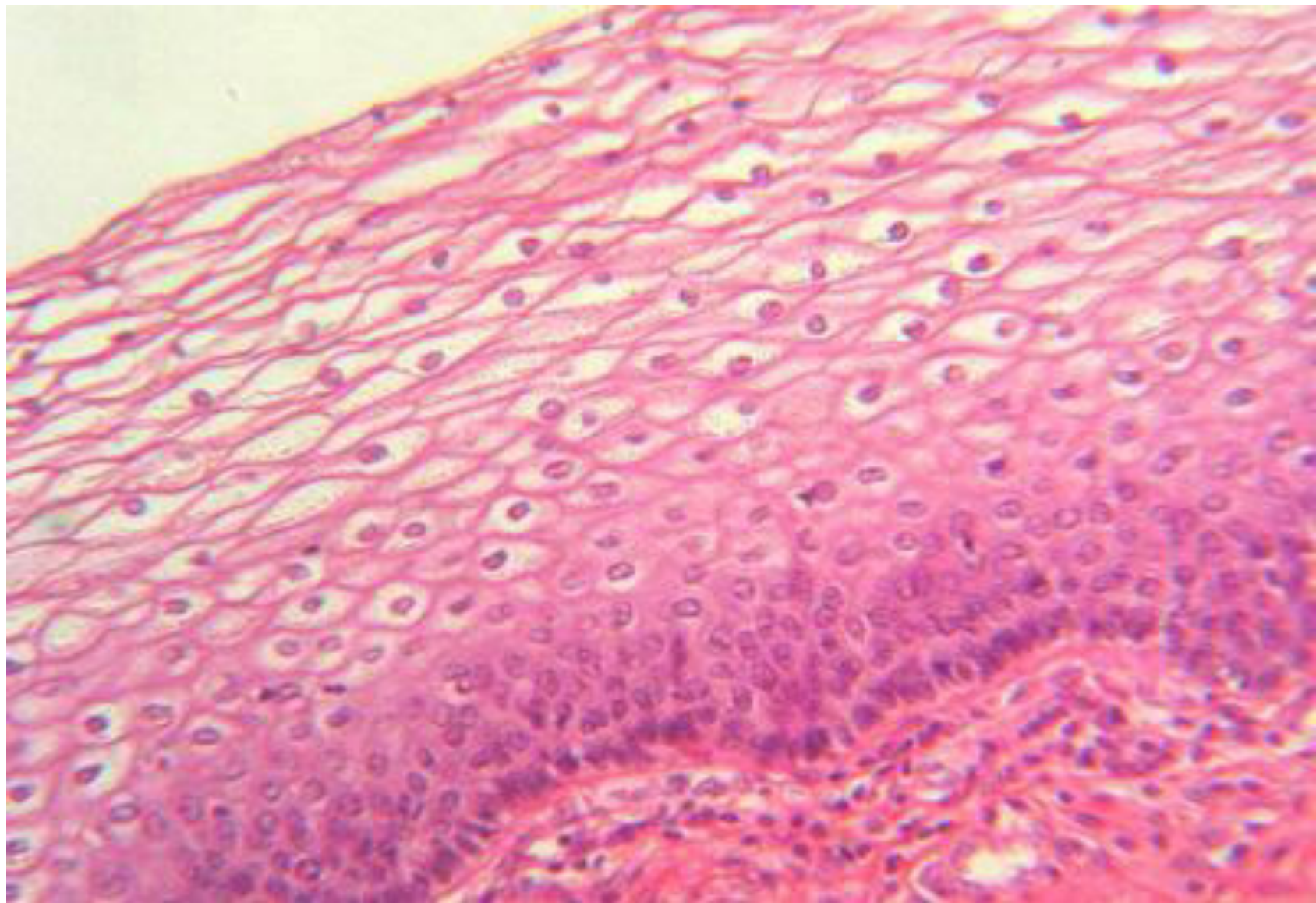


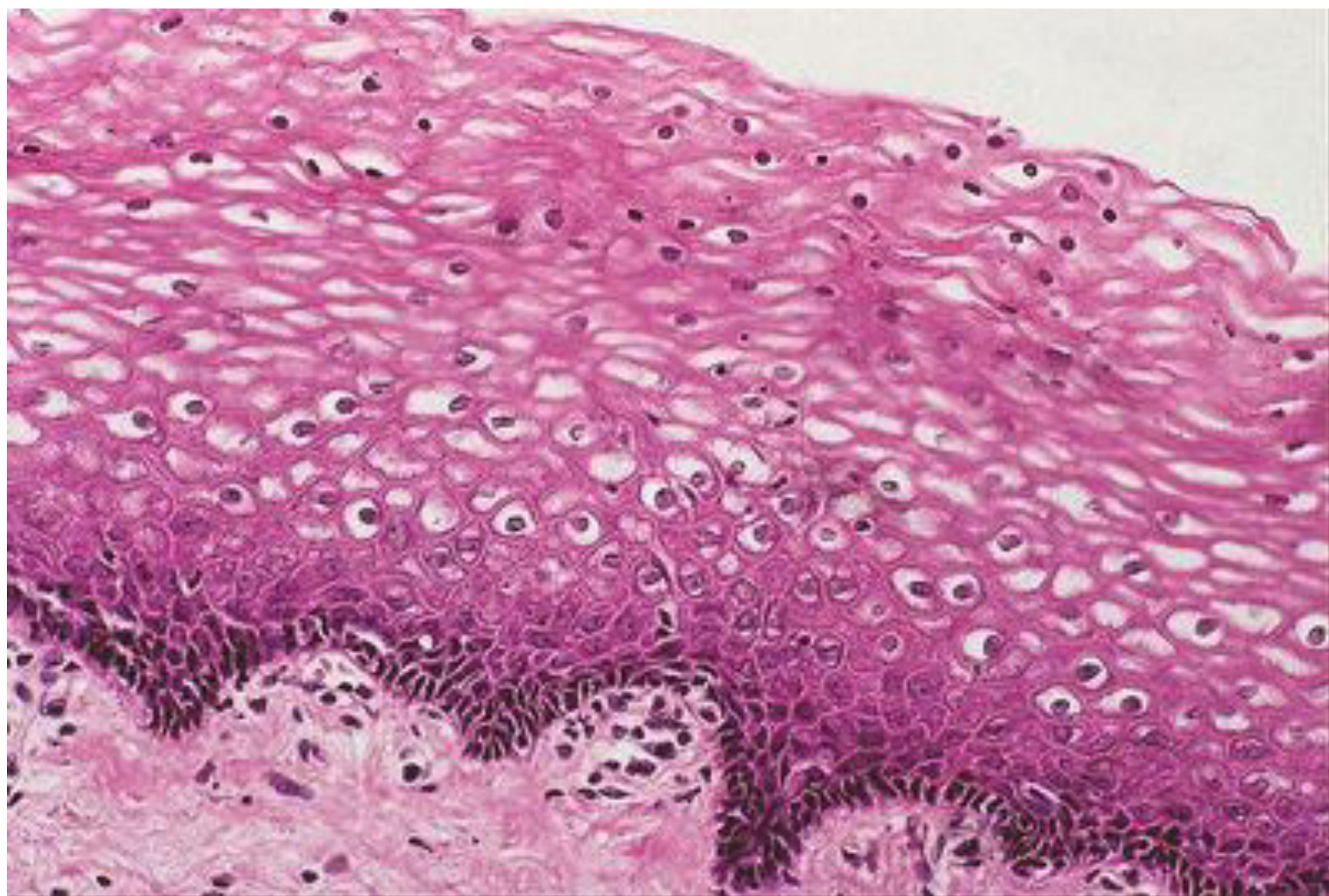
# Stratified squamous nonkeratinized epithelium

- The cell surface become flat but remain nucleated and cytoplasm contains little keratin.
- Lines the surfaces which are submitted to abrasion but remain wet.
  - Oral Cavity
  - Oropharynx
  - Esophagus
  - Vagina



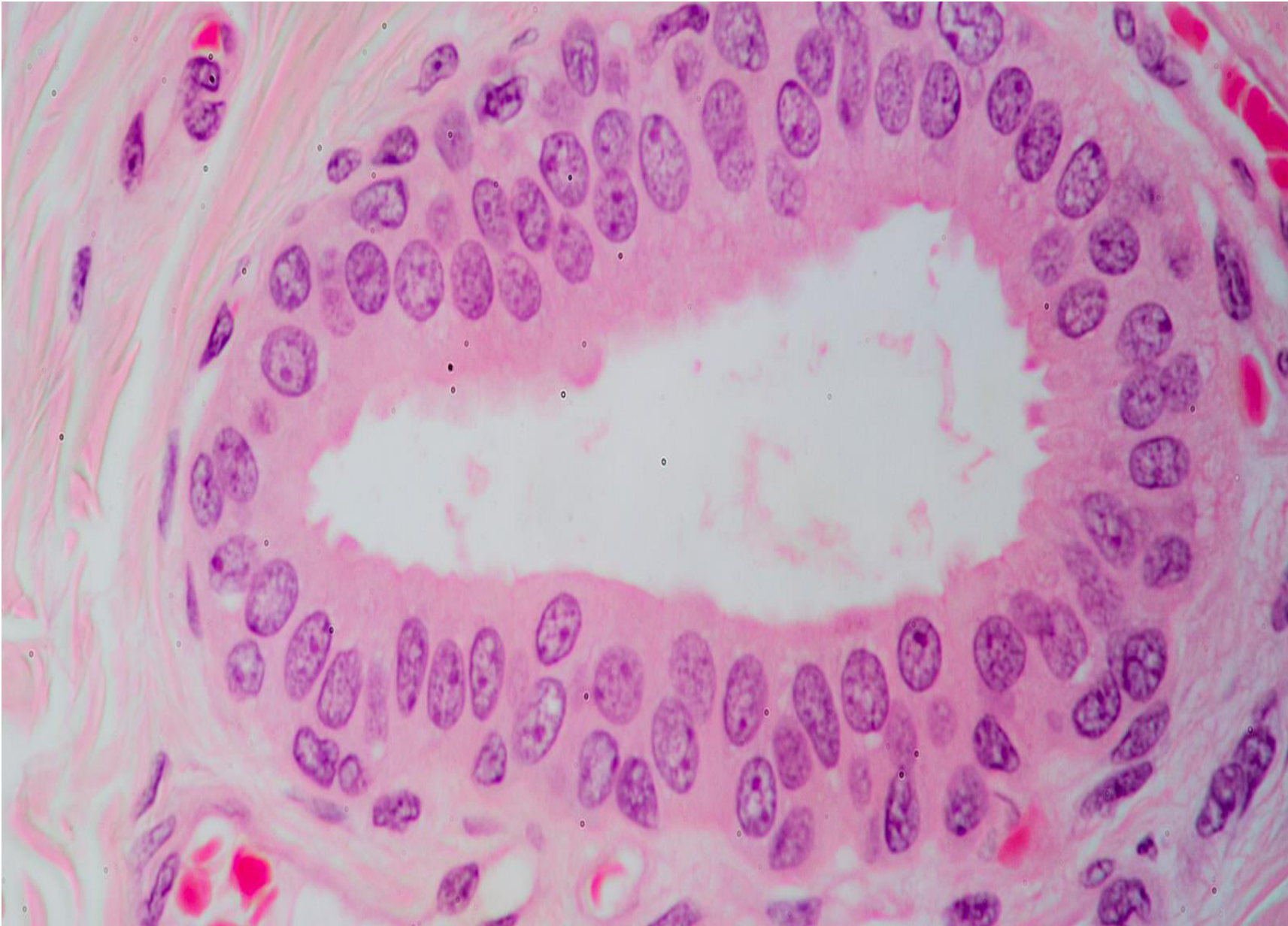
**Photomicrograph:** Stratified squamous epithelium lining of the esophagus (300 $\times$ ).





# Stratified cuboidal epithelium

- Consists of two or more layers of cuboidal cells
- Lining of the large ducts of pancreas and salivary glands
- The ducts of sweat glands are also lined by stratified cuboidal epithelium.



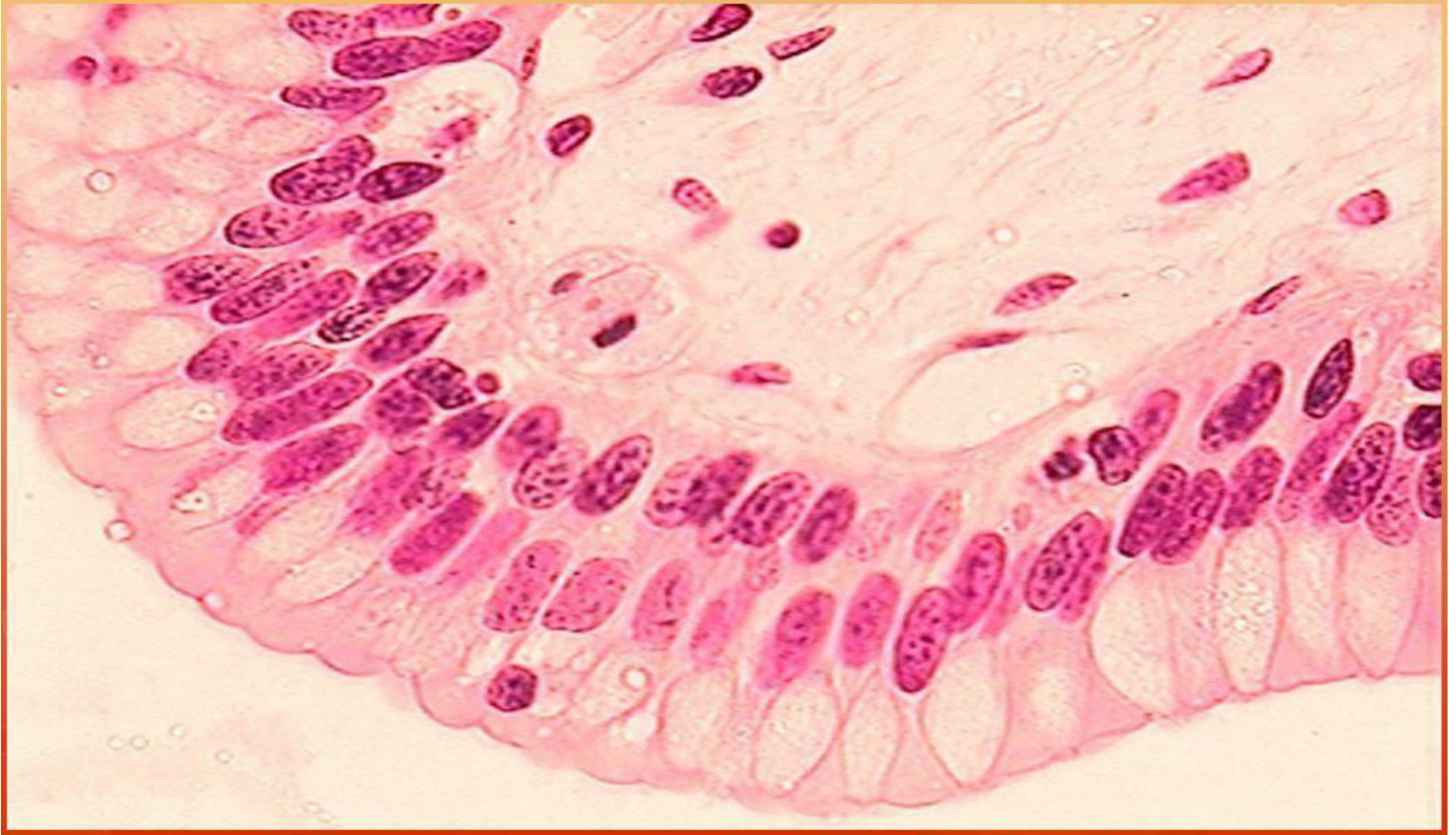




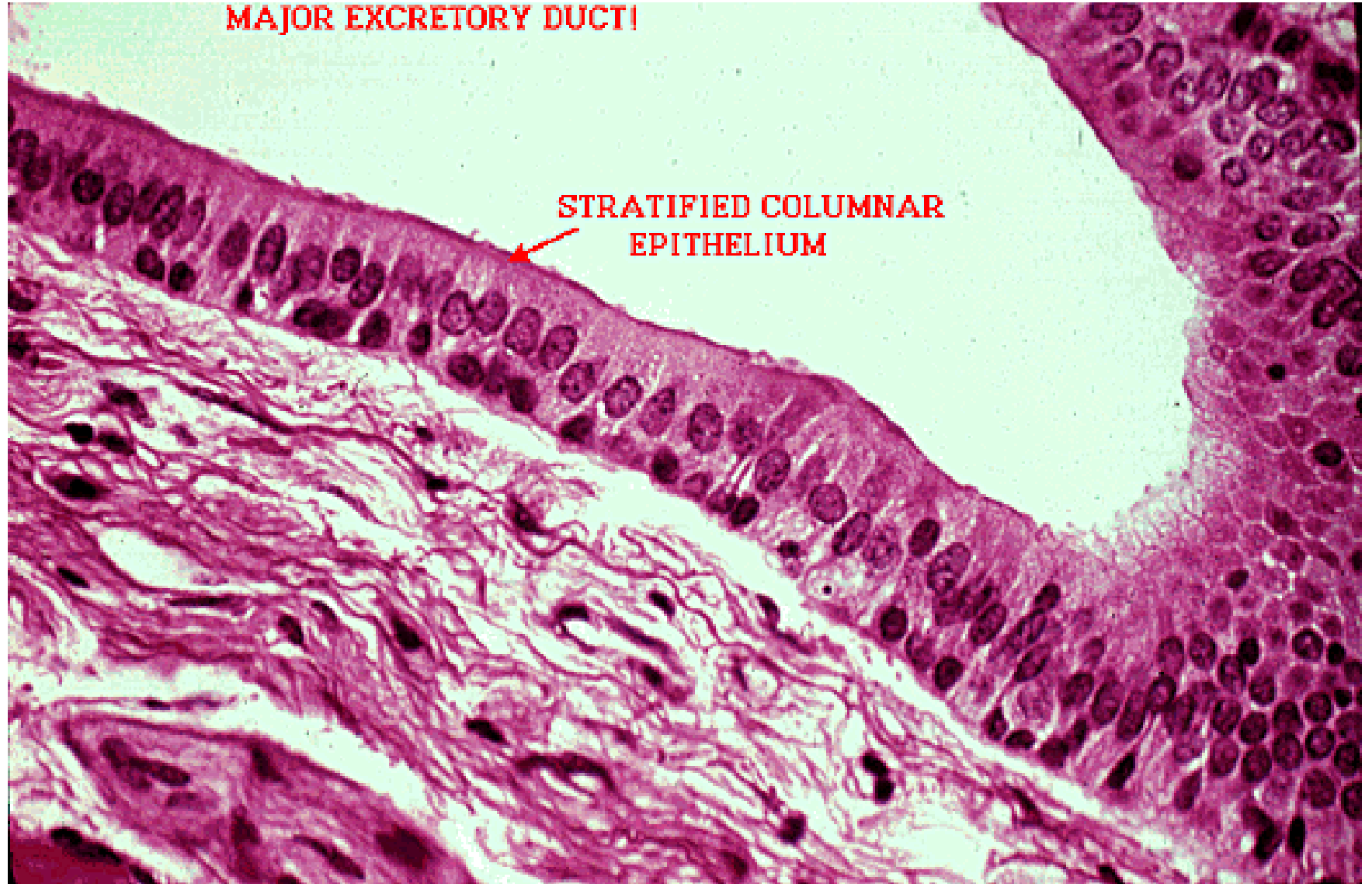
# Stratified Columnar Epithelium

- A rare type of **epithelium** composed of column shaped cells arranged in multiple layers.
- Found in the conjunctiva of the eye, in parts of the pharynx, anus, and the male urethra.

# Stratified Columnar Epithelium



**MAJOR EXCRETORY DUCT!**

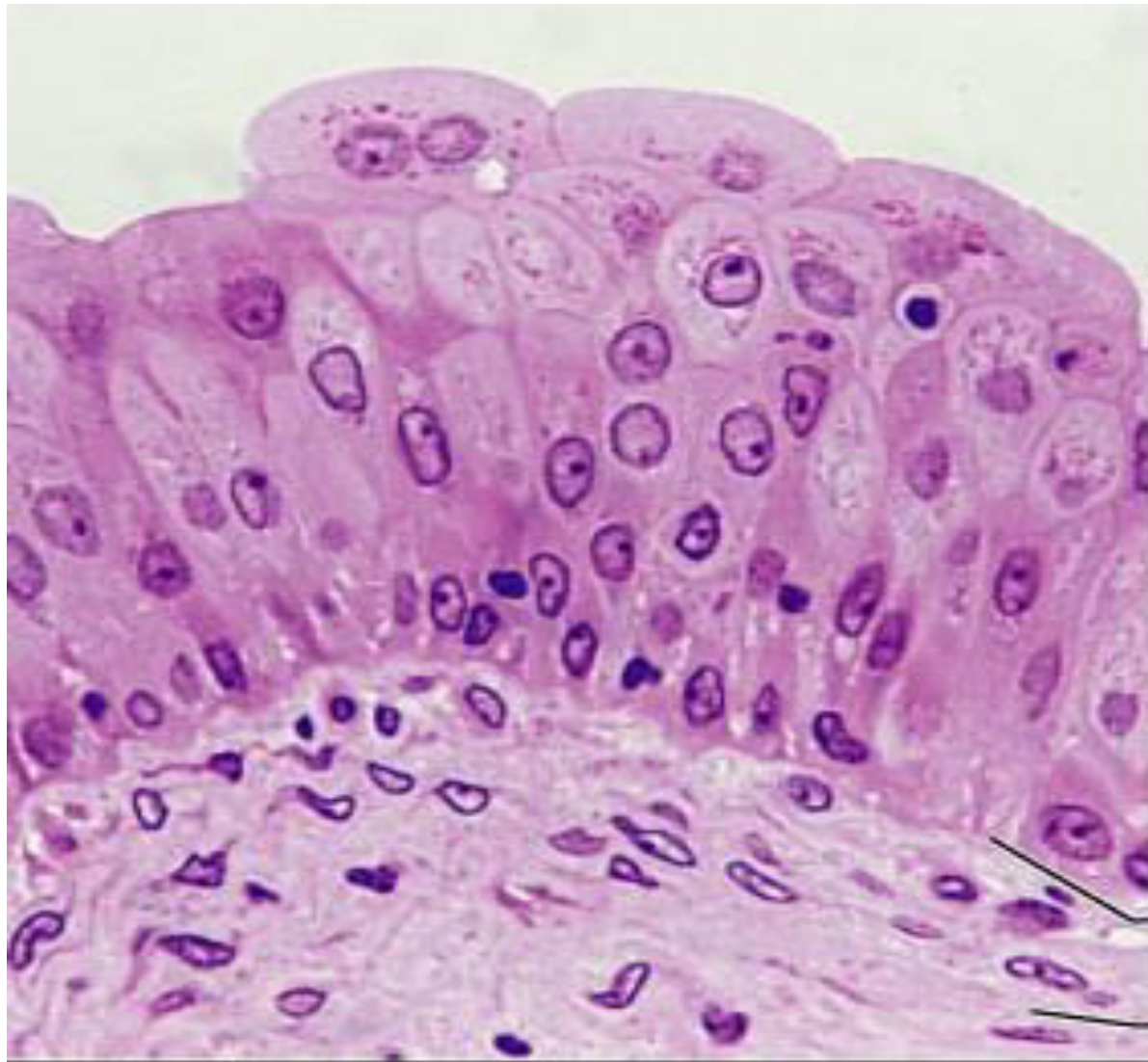


**STRATIFIED COLUMNAR  
EPITHELIUM**

# Transitional Epithelium

- Also known as **uroepithelium** or **urothelium**
- In contracted state the urothelium consist of 6 or 8 layers.
- The basal layer contains cuboidal cells then several layers of polygonal cells.
- The most superficial layer consist of large **dome shaped cells**

- In stretched state urothelium consist of 2 or 3 layers .
- The basal layer of cuboidal cells and one or two layers of large flat cells.



Transitional epithelium

Basement membrane

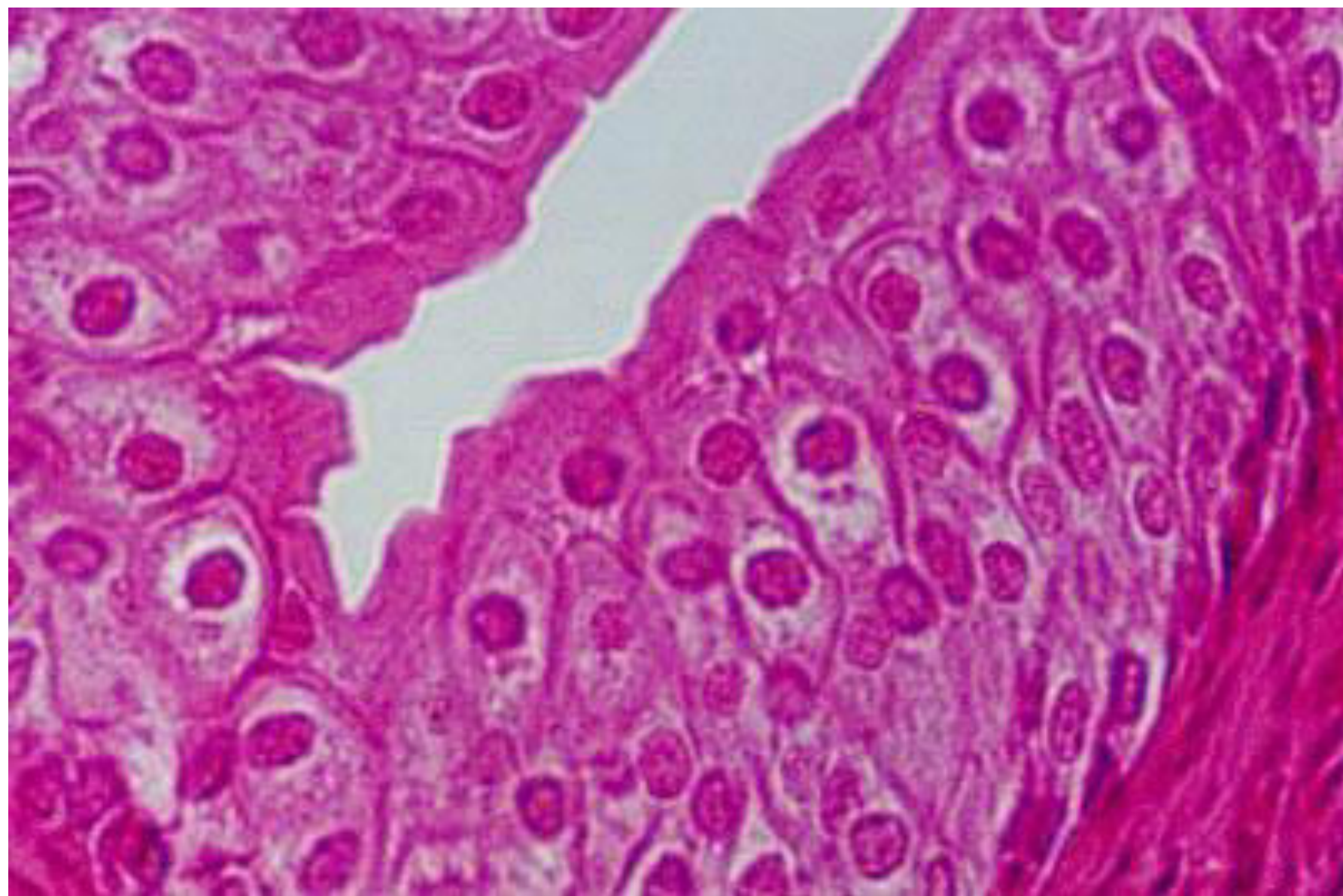
Connective tissue



gettyimages  
Ed Reschke

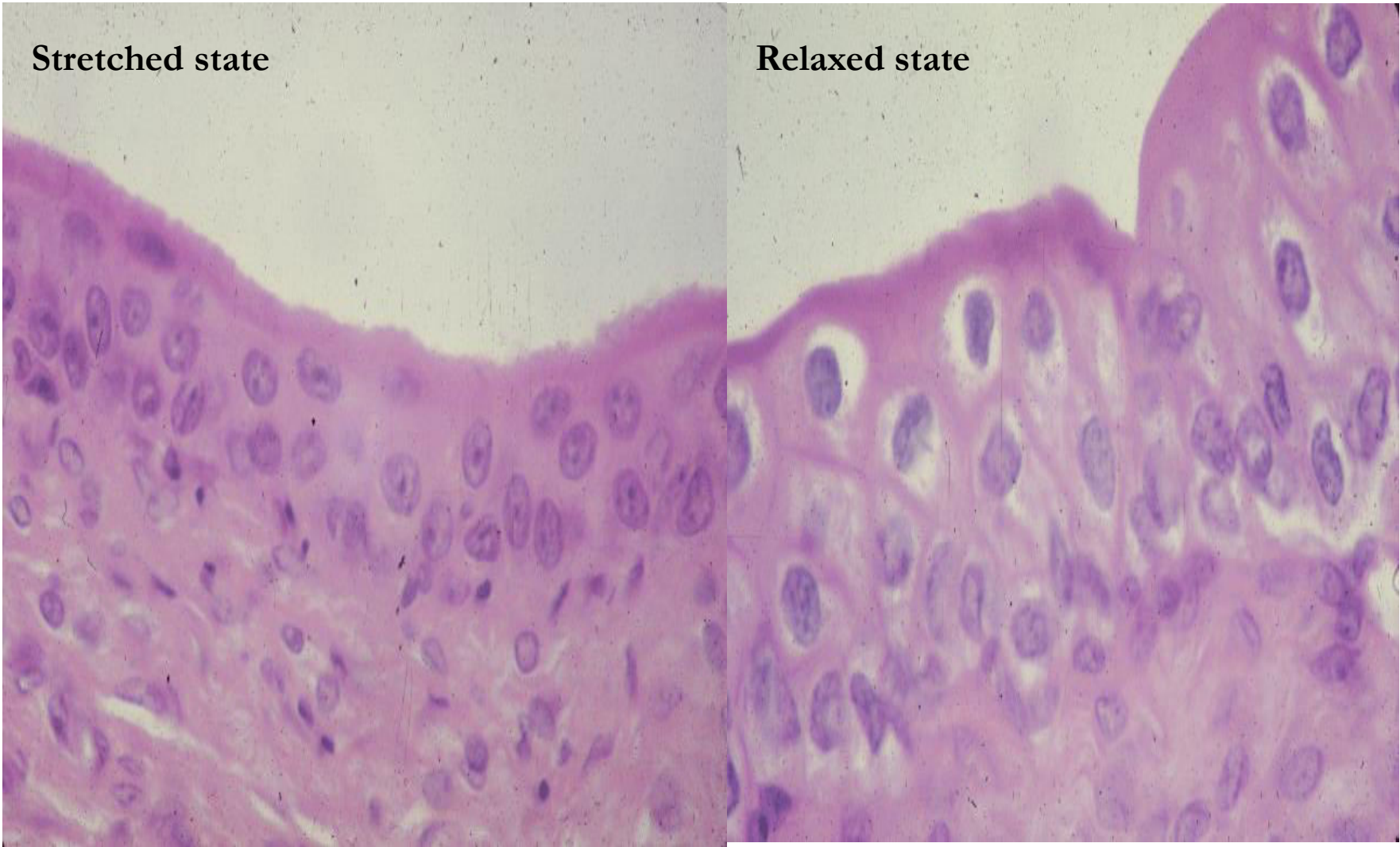
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**Stretched state**

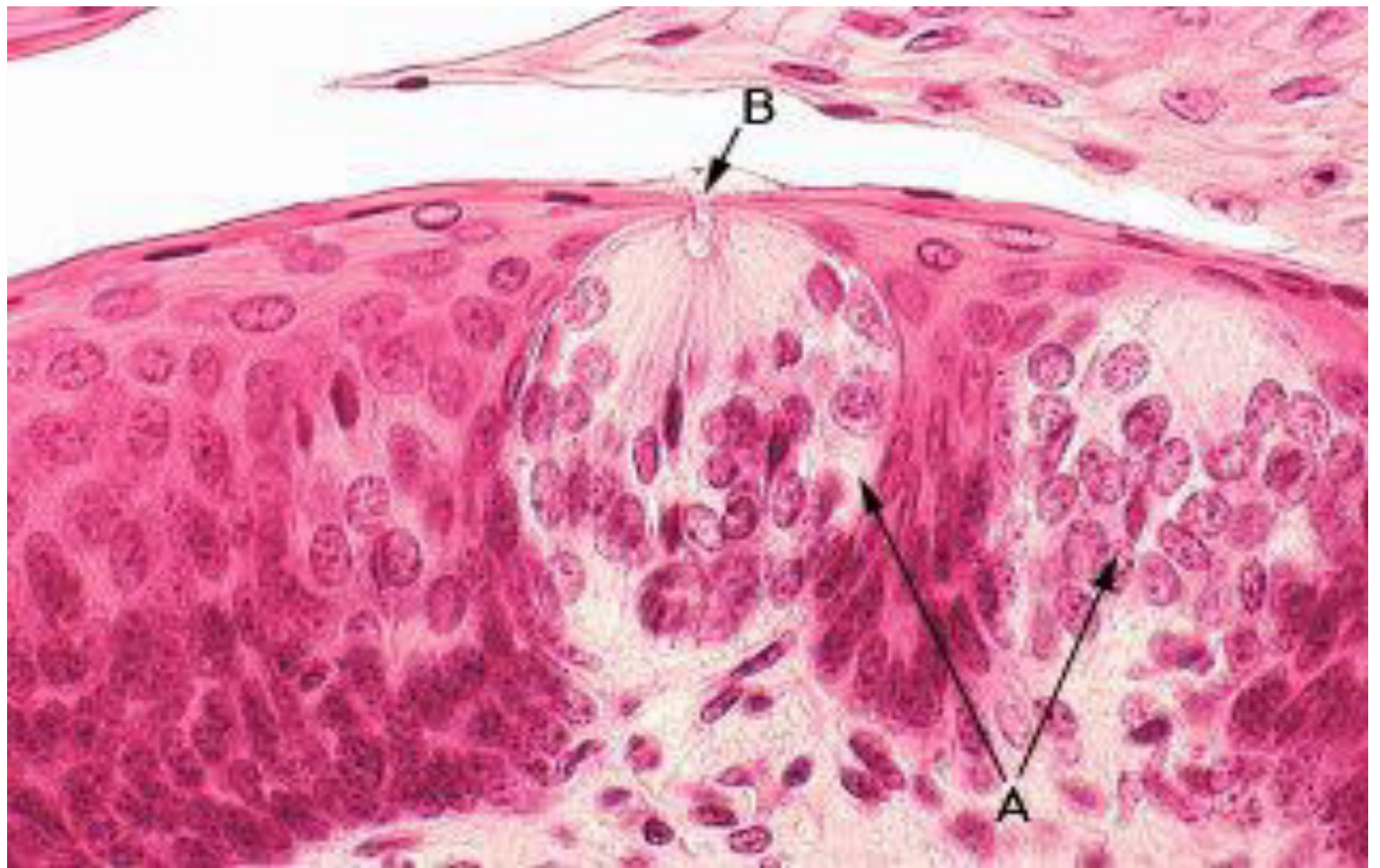
**Relaxed state**

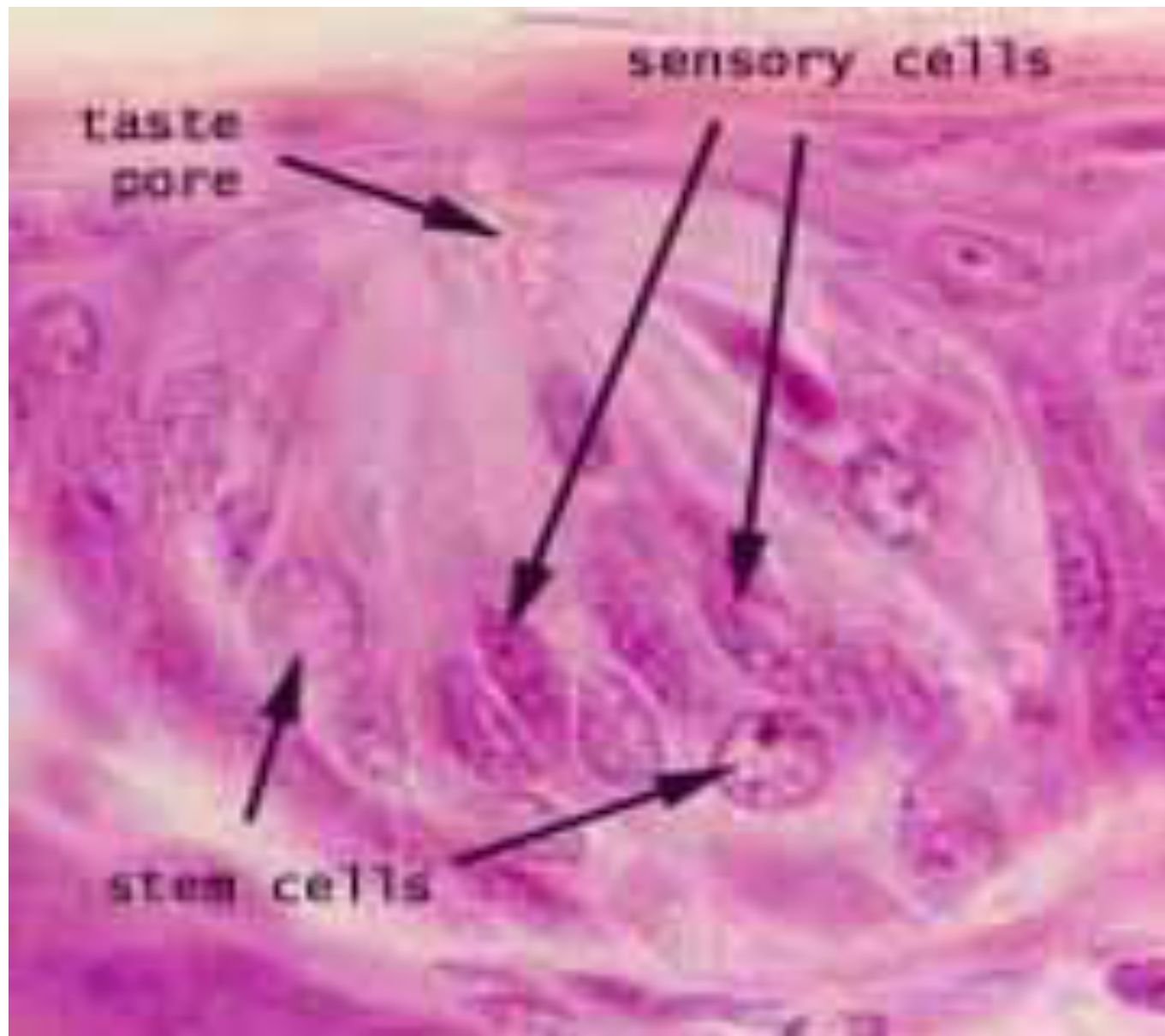


# Epithelial Cells

## Neuroepithelial cells:

- These are tall columnar cells bearing cilia or stereocilia on their free surface.
- These are sensory receptors for reception of external stimuli.
- Found in special sense organs like **taste buds** and vestibulocochlear receptor of **internal ear**.

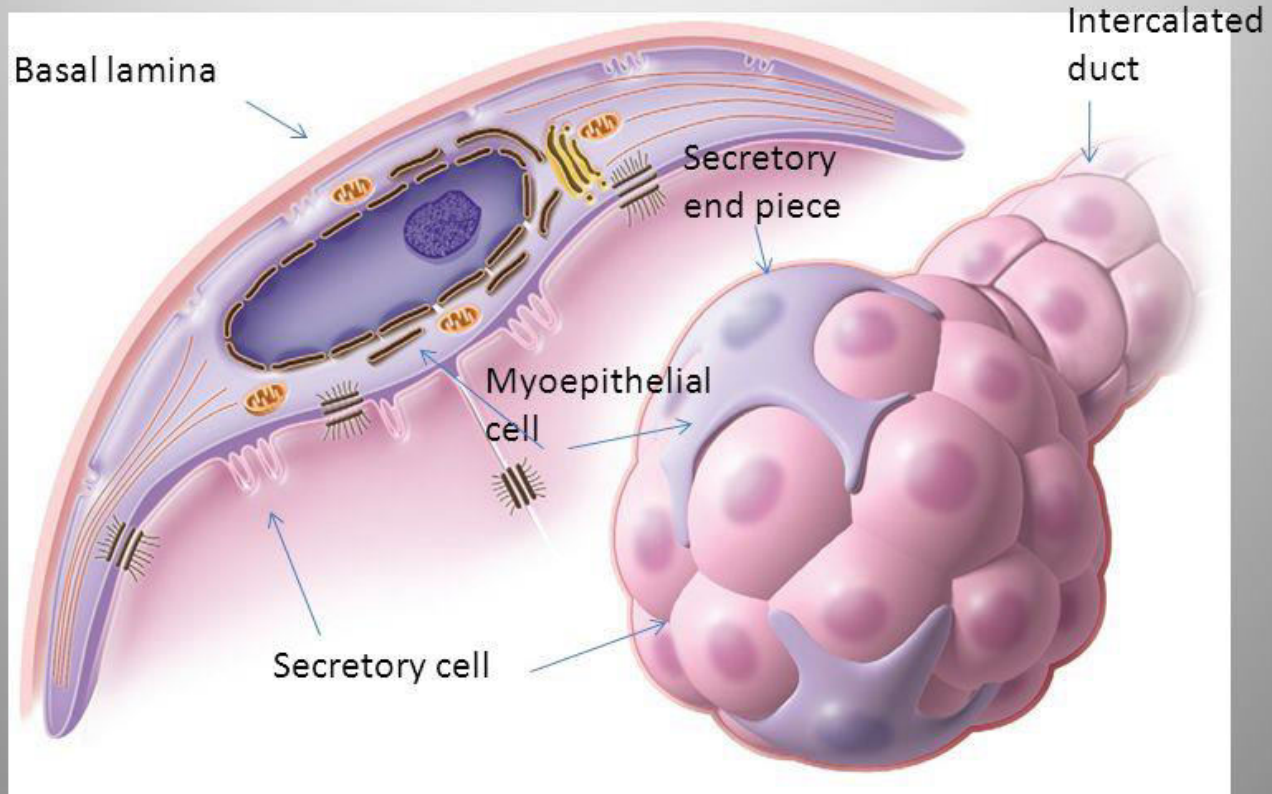


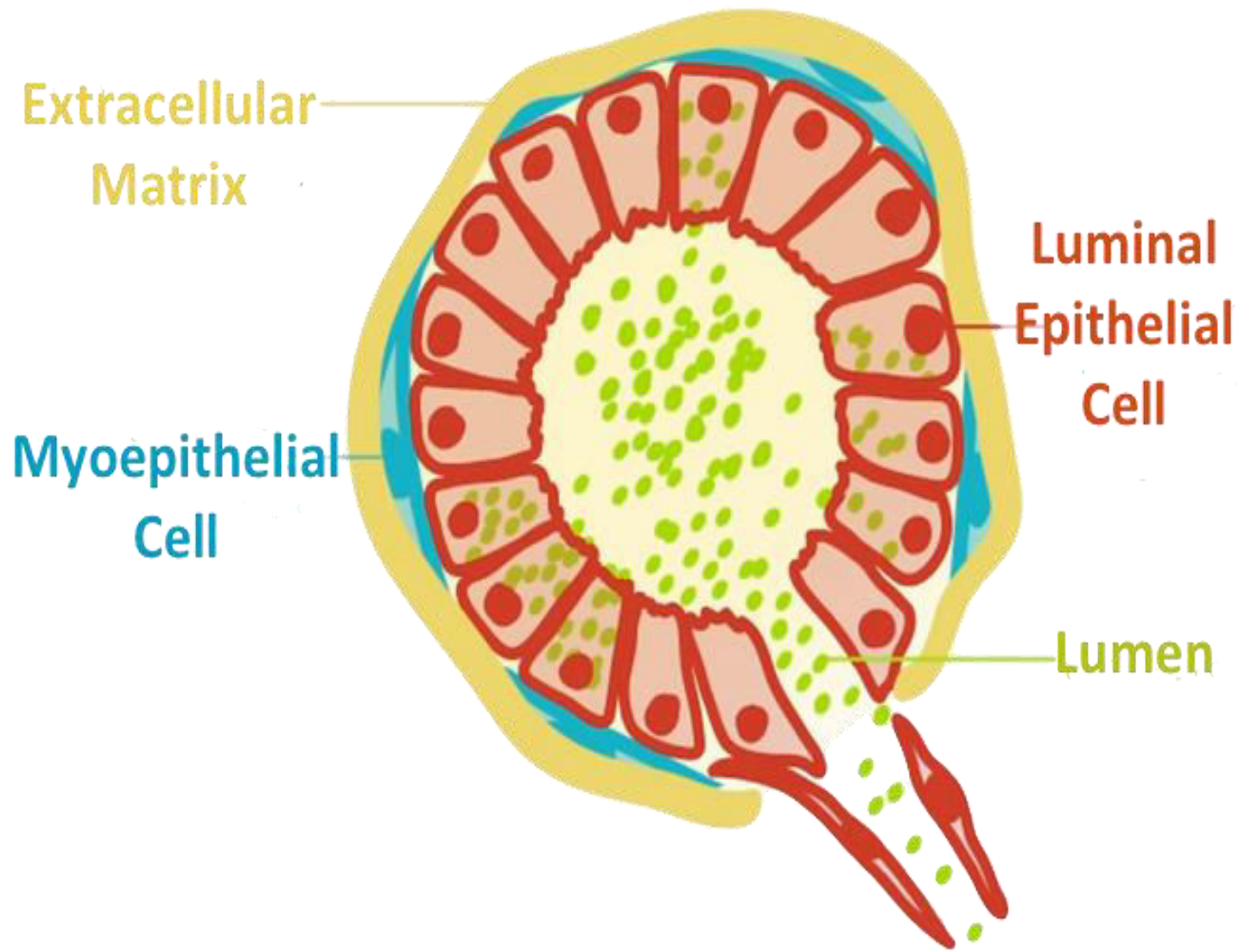


# Myoepithelial cells

- Also known as basket cells are stellate, star shaped cells with process.
- Their cytoplasm contains contractile actin and myosin filaments.
- These cells contract when stimulated by neurohormonal signals.
- Found around the secretory acini of mammary, salivary, lacrimal and sweat glands.

# MYOEPITHELIAL CELLS





Extracellular  
Matrix

Luminal  
Epithelial  
Cell

Myoepithelial  
Cell

Lumen



# Epithelial Surface Features

## Apical surface features

***Microvilli*** – finger-like extensions of plasma membrane found on the free surface of cell.

- Abundant in epithelia of small intestine and kidney
- Microvilli are too small to be seen with the LM.
- Maximize surface area for an absorptive function.

# Epithelial Surface Features

***Cilia***: Hair like, highly motile extensions of apical surface of epithelial cells

- Cilia are specialized for transport of fluid over the epithelial surface.
- Due to rapid to and fro movements, cilia are also referred as ***kinocilia***.
- Kinocilia are present in respiratory tract, uterine tube and sensory region of internal ear.

# Epithelial Surface Features

## Stereocilia:

- Appear as thin, hair like structure.
- Are non-motile apical modifications of the cell
- In structure, they are longer than microvilli.
- They are found in three regions of the body:
  - ❖ Ductus deferens
  - ❖ Epididymis
  - ❖ Internal ear

# Lateral Surface

- The lateral surface of each epithelial cell lies in close contact with lateral surface of adjacent cell.
- Two main functions are : *Cell adhesion* and *communication*
- The function is dependent on three factors:
  1. Presence of cadherins
  2. Presence of invagination and evagination
  3. Presence of adhering and occluding junction

# Basal surface

- The basal surface is characterized by presence of three features:
  1. **Basal Lamina** (thin layer of extracellular material is located between epithelial cells and the connective tissue)
  2. **Hemidesmosomes** (junction between epithelial cells and basal lamina)
  3. **Infoldings of plasmalemma** (multiple foldings to increase surface area of plasma membrane)

# Basement Membrane

- A thin, fibrous, extracellular matrix of tissue that separates the lining of body surface from underlying connective tissue.
- Under LM the basement membrane was considered to be composed of two layers: **Basal lamina and Reticular lamina.**
- Under EM the reticular lamina was actually part of underlying connective tissue.
- Now the basement membrane is considered to consist of basal lamina only which contain **collagen fibers, glycoprotein and fibronectin.**



epithelium

↑  
basement  
membrane

lamina propria

**TEST**  
**&WOW**



